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When the stress of quitting meets the cost of playing: An Experiment on to quit or not to quit?

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When the stress of quitting meets the cost of playing: An Experiment on to quit or not to quit?*

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Abstract

Business-owners often postpone disinvestment decisions even when future profits are not expected to compensate for current losses. We use an experiment to study one possible behavioral motivation. Studies in psychology suggest that making decisions is stressful and, consequently, many people prefer to buck-pass their decisions to someone else or to postpone them to future periods. Other people, however, are vigilant subjects that are able to make efficient decisions. In our experiment, we measure subjects' buck-passing, vigilance and risk-aversion traits and study their performance in games in which they have to make investment and disinvestment decisions. We find that the number of rounds most subjects play is greater than the number expected by real-option theory but that vigilant and risk-averse subjects tend to make decisions that are more efficient than all other subjects, that vigilant but not risk-averse subjects tend to shirk making the investment decisions and that buck-passing and not risk-averse subjects tend to postpone their disinvestment decisions even when they make losses that would have induced most other subjects to disinvest.

Keywords: buck-passing, conflict theory of decision making, disinvestment decisions, economic experiment, optimal stopping, player types, risk aversion, vigilance.

JEL Codes: D03, D81, L26

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Zusammenfassung

Unternehmer sind dafür bekannt, Desinvestitionsentscheidungen zu verschieben, auch wenn die Erwartung über zukünftige Gewinne nicht ausreicht, um die derzeitigen Verluste zu kompensieren. Wir führen eine experimentelle Studie durch, um einen möglichen Treiber dieses Verhaltens besser zu verstehen. Psychologische Studien zeigen, dass das Treffen von Entscheidungen mit Stress verbunden sein kann, und dass viele Menschen daher eine Neigung haben, entweder andere ihre Entscheidungen treffen zu lassen oder diese auf zukünftige Perioden zu verschieben. Andere Personen sind dagegen wachsam und dazu in der Lage, effizient zu entscheiden. In unserem Experiment messen wir die Tendenz von Personen, ihre Entscheidungen zu verschieben bzw. wachsam zu sein sowie deren Risikobereitschaft und beobachten, wie gut diese in Spielen abschneiden, in denen sie Investitions- und Desinvestitionsentscheidungen treffen müssen. Unsere Ergebnisse zeigen, dass die meisten Personen mehr Runden spielen, als dies auf Basis der Realoptionstheorie erklärt werden kann, dass aber zugleich wachsame und risikoaverse Personen Entscheidungen treffen, die näher an eine effiziente Entscheidung herankommen als die anderer Personen. Wir zeigen weiterhin, dass wachsame, aber nicht risikoaverse Personen dazu neigen, die Investitionsentscheidung gar nicht erst zu treffen (d.h., die Teilnahme an dem Spiel zu vermeiden), und dass verschiebende und nicht risikoaverse Personen dazu neigen, ihre Desinvestitionsentscheidungen auch dann spät zu treffen, wenn sie Verluste machen, bei denen andere längst mit dem Spiel aufgehört hätten.

Schlüsselwörter: Buck-passing (Entscheidungsverschiebungsneigung), Konflikttheorie der Entscheidung, Desinvestitionsentscheidungen, ökonomisches Experiment, optimal stopping, Spielertypen, Risikoneigung, Vigilance (Wachsamkeit)

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1 Introduction

When a decision has irreversible outcomes, it is often advisable to postpone it until more information becomes available. For example, land owners that contemplate selling their assets can often gain from waiting until market conditions improve. Entrepreneurs can often gain from waiting before closing losing businesses because demand sometimes increases over time (Titman, 1985, Brennan and Schwartz, 1985, McDonald and Siegel, 1986, Dixit, 1991, Dixit and Pindyck, 1994, Weeds, 2002).

Decisions, however, are often postponed even when waiting is unlikely to be profitable. For example, Madrian and Shea (2001) find that new employees often lose significant sums because they postpone signing 401(k) schemes and Della Vigna and Malmendier (2004) report evidence suggesting that members of health clubs do not cancel their subscriptions long after they stop to practice.

Research in psychology suggests that a possible explanation for these postponements is the mental costs of the decision making process (Thaler, 1981, O'Donoghue and Rabin, 1999, 2001, Angeletos et al., 2001, Loewenstein and Lerner, 2003). According to the theory of decision making, most subjects face stress when they have to make a decision (Janis and Mann, 1977, Loewenstein and Lerner, 2003). Some subjects have the ability to handle this stress efficiently and, therefore, these subjects usually execute their decisions at the most appropriate times. Janis and Mann (1977) define such subjects as *vigilant*. Most subjects, however, often do not handle the cognitive stress efficiently.

Procrastinators are subjects that cannot efficiently handle the stress when the decisions involve instantaneous costs and future benefits. Procrastinator students, for example, often do not start writing assignments until the last moment, although they could probably improve their grades by starting earlier. Procrastinator employees often do not save enough for retirement because they prefer current consumption over future one (Thaler, 1981, 1984, Akerlof, 1991, Lowenstein and Prelec, 1992, O'Donoghue and Rabin, 1999, 2001, Angeletos et al., 2001, Ariely and Wertenbroch, 2002, Gul and Pesendorfer, 2004, Della Vigna and Malmendier, 2004, Grenadier and Wang, 2007).

Buck-passers also tend to postpone decisions, but they postpone the decisions because they are afraid of giving up on alternatives and not because they prefer immediate outcomes over future outcomes (Loewenstein and Lerner, 2003). Buck-passers therefore tend to postpone decisions when choosing one alternative implies giving up on other alternatives, especially when several of the alternatives seem similarly attractive. For example, a buck-passer that has to choose between two models is likely to postpone his decision even if he were to buy any of the models if it was offered on its own (Shafrir et al., 1993).

Janis and Mann (1977) suggest that in addition to personality traits such as vigilance, procrastination and buck-passing, decision making also depends on risk perceptions. When the outcomes of a decision are perceived as risky, the decision maker is more likely to process all the relevant information than when the outcomes are perceived as involving a low risk. It can be expected, therefore, that risk-averse subjects will be more likely to process relevant information before making or postponing a decision than other subjects because risk-averse subjects are more likely to perceive a given decision as risky.

In the next sections, we report the results of an experiment that tested the effects of the interactions between risk-aversion, buck-passing, and vigilance on the postponement of decisions. The experiment began with an investment stage that was followed by a game stage. In the game the subjects needed to make a series of disinvestment decisions and in most cases, the games had a positive expected value. The positive expected value depended, however, on the disinvestment decisions and failing to disinvest in time could have cost significant shares of the payoffs. Sandri et al. (2010) show that in a similar scenario, most subjects tended to postpone their disinvestment decisions although the postponement cost them significant sums. They also show that there were significant differences between individuals' tendencies to disinvest earlier or later and that those differences cannot be explained by differences in risk aversion only. We extend their findings by providing evidence that some of the differences can be explained by dividing subjects into *types* according to their scores in vigilance, buck-passing and risk-aversion tests.

Subjects that were both *risk-averse* and *vigilant* usually chose to invest and they also made better disinvestment decisions than all the other subjects. Subjects that were vigilant but not risk-averse were more likely than other subjects to give up on the investment opportunity. When they did invest, however, vigilant but not risk-averse subjects tended to postpone their disinvestment decisions even when this postponement cost them significant sums. All other subjects usually invested and then postponed their disinvestment decisions. Consequently, these subjects earned less than risk-averse and vigilant subjects. The subjects that made the smallest profits were subjects that had both high scores of buck-passing and low scores of risk-aversion.

The combination of an economic experiment and psychological personality scales therefore provides results that can assist in the better understanding of individuals' timing of decisions. The results may therefore be useful in predicting the timing of decisions which have irreversible outcomes, such as decisions on investment, disinvestment, purchase, savings and education.

The rest of the paper is organized as follows. In section 2 we describe the methodology and the data. In section 3 we present the theoretical background and our hypotheses. In section 4 we present our results and we conclude in section 5.

2 Data and Methodology

The settings of our experiment are based on Sandri et al. (2011). The experiment was fully computerized and conducted at a computer lab in a major German university. The participants were 85 students and non-students that were recruited via the university's internet site. Each subject participated in one of seven sessions and the number of subjects in each session was between 7 and 14. All the sessions were conducted in one week in November 2010.

Each subject participated in one of two treatments. The first treatment was a *compound-interest* treatment and the second was a *decreasing-interest* treatment. In both treatments, subjects received a show up fee of 18,000 points. The exchange rate was 6000 points for one Euro.[1].

Before starting the experiment, the subjects read the instructions and then answered several questions that tested their understanding. When all the subjects completed answering all the questions correctly, each subject played one practice game. The practice game was followed by six games that counted for the payoff.[2]

The settings in the *compound-interest* treatments were as follows. Each of the six games was composed of an *investment-opportunity* stage and a game stage. In the investment-opportunity stages, each subject received information about the investment's *cost*, about the possible profits in the game stage and about the profits if he decides not to invest. The subject then decided whether he pays the investment-cost and plays the game or does not invest and skips the game.

The investment's *cost* was either 10,000 or 15,000 points. If a subject chose to skip an investment opportunity, he earned a payoff that was composed of the initial endowment of 18,000 points plus 10% per round interest on the cost, accumulated over 11 rounds. Thus, when the cost was 10,000 points, a subject that skipped the investment opportunity received $18{,}000 + 10{,}000\times(1.1^{11} - 1) = 36{,}531$ points. When the cost was 15,000 points, a subject that skipped the investment opportunity received $18000 + 15{,}000\times(1.1^{11} - 1) = 45{,}797$ points.

If a subject chose to invest, he paid the investment's cost and played the game. The game was composed of up to 11 rounds. In the beginning of the first round, a subject that chose to invest received a *first-round-prize* which was either 1,000 or 1,500 points. The subject had then to choose between continuing to the next round and disinvesting. If he chose to disinvest he received a *disinvestment-prize* which was either 11,000 or 16,000 points. The subject also received a 10% per round interest on the disinvestment-prize and on the first-round prize, accumulated over the ten rounds left to play.

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1 At the time of the experiment, 1 Euro was equivalent to about 1.42 US Dollars.

2 We used Z-Tree to program the experiment (Fischbacher, 1999, 2007).

If the subject chose to continue, he proceeded to the second round. In the second round he received the second *round-prize* which, with 50% probability, was greater than the first-round prize and with 50% probability was smaller than the first-round prize. The subject then chose whether he continues to the next round or disinvests. If he disinvested, he received the disinvestment prize, the prizes he accumulated in the first and second rounds and 10% interest per round on these sums, accumulated over the nine rounds left to play. If the subject chose to continue, he proceeded to the third round. In the third round the subject again received the round's prize, which was again either greater, with 50% probability, or smaller, with 50% probability than the prize in the second round. The subject then had to choose whether he continues to the next round or disinvests, and so forth. The game ended when the subject chose to disinvest or when the subject reached the end of the 11th round. When the game ended, the subject received the disinvestment prize, the prizes he accumulated in all the rounds he played and a 10% interest per round on this sum, accumulated over the rounds left to play.

The size by which the rounds' prizes changed between every two consecutive rounds was determined by the game's *variance.* In half of the games, the variance was 200 points and in the other half it was 1,000 points. Thus, when the first round's prize was 1,000 points and the *variance* was 200 points, the second round's prize was either 1,200 or 800 points. If the second round's prize turned out to be 1,200 points, then the third round's prize could either be 1,000 points or 1,400 points. When the second round's prize was 800 points then the third round's prize could either be 600 or 1,000 points and so forth.

Before each round, the subjects received a table that depicted the information on possible prizes and the probabilities in a table form. Figures 1 and 2 are examples of such tables that were seen by a specific subject in the first and second rounds that he played, respectively. Table 1 shows all the prizes the subject could have won in each of the rounds between the 1st and until the 11th. The parentheses below each prize give all the probability of winning that prize. For example, the table shows that the probability of winning 1,200 points in the second round was 50% and the probability of winning 1,400 points in the third round was 25%. Figure 2 is shows the information presented to the subject in the second round. The second round prize was 1,200 points and, therefore, the subject's probability of winning 1,400 points in the third round increased to 50% and his probability of winning 600 points in the third round decreased to zero. Consequently, the option of winning 600 points in the third round does not appear in Table 2.

Figure 1. Screenshot of payoffs and probabilities in round 1

Runde 1	Runde 2	Runde 3	Runde 4	Runde 5	Runde 6	Runde 7	Runde 8	Runde 9	Runde 10	Runde 11
1000 (100.0%)	1200 (50.0%)	1400 (25.0%)	1600 (12.5%)	1800 (6.3%)	2000 (3.1%)	2200 (1.6%)	2400 (0.8%)	2600 (0.4%)	2800 (0.2%)	3000 (0.1%)
	800 (50.0%)	1000 (50.0%)	1200 (37.5%)	1400 (25.0%)	1600 (15.6%)	1800 (9.4%)	2000 (5.5%)	2200 (3.1%)	2400 (1.8%)	2600 (1.0%)
		600 (25.0%)	800 (37.5%)	1000 (37.5%)	1200 (31.3%)	1400 (23.4%)	1600 (16.4%)	1800 (10.9%)	2000 (7.0%)	2200 (4.4%)
			400 (12.5%)	600 (25.0%)	800 (31.3%)	1000 (31.3%)	1200 (27.3%)	1400 (21.9%)	1600 (16.4%)	1800 (11.7%)
				200 (6.3%)	400 (15.6%)	600 (23.4%)	800 (27.3%)	1000 (27.3%)	1200 (24.6%)	1400 (20.5%)
					0 (3.1%)	200 (9.4%)	400 (16.4%)	600 (21.9%)	800 (24.6%)	1000 (24.6%)
						-200 (1.6%)	0 (5.5%)	200 (10.9%)	400 (16.4%)	600 (20.5%)
							-400 (0.8%)	-200 (3.1%)	0 (7.0%)	200 (11.7%)
								-600 (0.4%)	-400 (1.8%)	-200 (4.4%)
									-800 (0.2%)	-600 (1.0%)
										-1000 (0.1%)

Source: own calculations

Figure 2. Screenshot of payoffs and probabilities in round 2, given high payoff in round 1

Runde 1	Runde 2	Runde 3	Runde 4	Runde 5	Runde 6	Runde 7	Runde 8	Runde 9	Runde 10	Runde 11
	1200 (100%)	1400 (50.0%)	1600 (25.0%)	1800 (12.5%)	2000 (6.3%)	2200 (3.1%)	2400 (1.6%)	2600 (0.8%)	2800 (0.4%)	3000 (0.2%)
		1000 (50.0%)	1200 (50.0%)	1400 (37.5%)	1600 (25.0%)	1800 (15.6%)	2000 (9.4%)	2200 (5.5%)	2400 (3.1%)	2600 (1.8%)
			800 (25.0%)	1000 (37.5%)	1200 (37.5%)	1400 (31.3%)	1600 (23.4%)	1800 (16.4%)	2000 (10.9%)	2200 (7.0%)
				600 (12.5%)	800 (25.0%)	1000 (31.3%)	1200 (31.3%)	1400 (27.3%)	1600 (21.9%)	1800 (16.4%)
					400 (6.3%)	600 (15.6%)	800 (23.4%)	1000 (27.3%)	1200 (27.3%)	1400 (24.6%)
						200 (3.1%)	400 (9.4%)	600 (16.4%)	800 (21.9%)	1000 (24.6%)
							0 (1.6%)	200 (5.5%)	400 (10.9%)	600 (16.4%)
								-200 (0.8%)	0 (3.1%)	200 (7.0%)
									-400 (0.4%)	-200 (1.8%)
										-600 (0.2%)

Source: own calculations

Table 1. Games' summary statistics

					Quit if the round's prize is smaller or equal to:												
Game	**Cost**	**Disinvestment-prize**	**First-prize**	**Variance**	**Round 1**	**Round 2**	**Round 3**	**Round 4**	**Round 5**	**Round 6**	**Round 7**	**Round 8**	**Round 9**	**Round 10**	**Round 11**	**Expected Rounds**	**Expected Payoff**
Low-variance-low-first-prize	10,000	11,000	1,000	200	800	800	800	800	800	800	800	800	800	1000	1,200	4.41	40,571
Low-variance-high-first-prize	10,000	11,000	1,500	200	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,500	1,500	4.37	48,971
High-variance-low-first-prize	15,000	16,000	1,000	1,000	-1,000	-1,000	-1,000	0	0	0	0	0	0	0	1,000	5.84	44,489
High-variance-high-first-prize	15,000	16,000	1,500	1,000	0	0	0	0	0	0	0	0	1,000	1,000	1,000	5.84	63,237
Extra-profit-low-variance	10,000	16,000	1,000	200	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	0	67,181
Extra-profit-high-variance	10,000	16,000	1,000	1,000	0	0	0	1,000	1,000	1,000	1,000	2,000	2,000	2,000	2,000	4.20	70,056
Lose-low-variance	15,000	11,000	1,000	200	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	0	45,797
Lose-high-variance	15,000	11,000	1,000	1,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	0	45,797

Remarks: All values are given in points (6000 points = 1€).
The expected payoff in the first six rows is equal to the expected payoff from the game of a subject who starts the game and follows a real-options strategy. It is composed of the expected payoff from the game, minus the cost and plus the initial endowment of 18,000 points.
The expected payoff in the final two columns is equal to the payoff of a subject that skips the game which is equal to the initial endowment of 18,000 points plus the interest on the cost

Source: own calculations

Table 1 summarizes the parameters of the various games. The table also gives the *trigger-prizes*, the *expected number of rounds* that a subject is expected to play and the *expected payoffs*. We find the trigger-prizes by backwards induction, as suggested by real options theory. The trigger-prizes of each round are, therefore, the minimum prizes that make a risk-neutral subject indifferent between continuing and disinvesting. (Dixit and Pindyck, 1994). The expected number of rounds was calculated by finding the probability that a subject will play each number of rounds before the prizes he wins drop below the trigger prizes. The expected profits were similarly calculated by finding the probability that the subject will win each prize, contingent on the rounds' prizes remaining greater than the trigger prizes.

The settings in the decreasing-interest treatment were identical to those in the compound-interest treatment, with the difference that in the decreasing-interest treatment, the subjects were informed that the disinvestment-prize will decrease by 10% for each round they choose to play. The disinvestment-prize in the first round, however, was the same as the disinvestment-prize including interest in the compound-interest treatment. Thus, the compound-interest and the decreasing-interest treatments were normatively identical, but in the compound-interest treatment the framing was of interest gains whereas in the decreasing-interest treatment the framing was of interest-loses.

After all the subjects finished playing the six games, they filled a Holt and Laury (2002) test for risk aversion. When all the subjects completed the Holt and Laury (2002) test, the computer picked one of the rounds at random and each subject was paid according to his payoffs in that round. The average payoff, including the show-up fee and the prizes for the Holt and Laury (2002) test was 9.50€.

All the subjects also completed a short questionnaire on their demographic and social-economic characteristics and a test on their patterns of decision making. The decision-making test was a German translation of the vigilance and the buck-passing scales developed in Mann et al. (1997). Each of the two scales is composed of six statements such as “I try to find the disadvantages of all the alternatives” and “I do not make decisions unless I really have to.” For each of the 12 statements, each subject indicated how much he agrees or disagrees with the statement on a five point scale that went from fully agree (2) to fully disagree (-2). We find that the Cronbach alphas of both the buck-passing and the vigilance items are satisfactory and similar to those reported in Mann et al. (1997). The Cronbch alpha for the vigilance scale in our sample is 0.85 compared to 0.80 in Mann et al. (1997) and the Cronbach alpha for the buck-passing scale is 0.82 compared to 0.87 in Mann et al. (1997). We also find that, as predicted, the two scales are negatively correlated (r= -0.17, p< 0.01). We therefore use the average of each subject's responses on the six buck-passing items as the subject's buck-passing score and the average of each subject's responses on the six vigilance items as the subject's vigilance score.

Table 2 reports the subjects’ summary statistics. The average age of the subjects is 27.8 and about 76% of them are students. Out of the students, about 14% study economics or business. The data suggests that subjects tend to report themselves as relatively high on the vigilance scale and relatively low on the buck passing scale. The average vigilance index is 0.79 and the average buck-passing index is -0.59. We define a subject's CRRA score as the CRRA coefficient that satisfies the subject's pattern of choices in the Holt and Laury (2002) test.[3] Negative scores therefore indicate that the subjects are risk-loving, zero indicates risk-neutral subjects and positive scores indicate that the subjects are risk-averse. The average CRRA score is 0.84, suggesting that most subjects in our sample are risk averse for the level of prizes offered in the experiment.

Table 2. Subjects' summary statistics

% Men	47.1%
% Born in Germany	81.1%
Average age	27.84 (SD: 7.646)
% Non Students	23.6%
% Business and Economics Students	10.5%
CRRA Index	0.86 (SD: 0.476)
Vigilance Index	0.84 (SD: 0.737)
Buck-Passing Index	-0.59 (SD: 0.789)
Number of subjects	85

Source: own calculations

3 Theory and Hypotheses

Janis and Mann (1977) conflict theory of decision making suggests that subjects often face significant stress before making a decision because they are not sure which of the alternative will yield the greatest benefit (Loewenstein and Lerner, 2003). Some subjects have the ability to handle this stress efficiently. Such subjects tend to process all the relevant information and, consequently, they usually choose the alternative that has the greatest expected benefit and execute it at the most appropriate time. Such subjects are known as *vigilant*.

Many subjects, however, do not handle the stress that they face when making a decision efficiently. Consequently, many subjects postpone their decisions because by postponing choice they avoid giving up on the other alternatives. Such subjects are known as *buck-passers*. *Buck-passers*, therefore, often postpone decisions when the decisions require choosing between several alternative that are all similarly attractive or similarly unattractive. For example, Buck-

3 About 18% of the subjects made more than one switch between the "safe" and the "risky" gambles in the Holt and Laury (2002) test. In these cases, we calculated the subjects' risk aversion according to the last switch from the safe to risky option that they made, thus giving these subjects the maximum risk aversion score implied by their responses. Dropping these subjects from the sample does not change our main results.

passers often postpone purchase decisions when a few of the models offered are similarly attractive (Shafrir et al., 1993). It also seems likely that buck-passing is one of the reason that subject hesitate before signing a 401(k) contract (Madrian and Shea, 2001).

In many situations, it is difficult to isolate the effects of buck-passing on the decision making because there are often several reasons for postponing decisions. Many subjects, for example, *procrastinate* before making a decision because they prefer current benefits over future ones, and therefore they tend to choose the alternative that gives the maximum immediate benefits and minimum immediate costs (O'Donoghue and Rabin, 1999, 2001, Angeletos et al., 2001, Ariely and Wertenbroch, 2002, Gul and Pesendorfer, 2004, Della Vigna and Malmendier, 2004). Procrastination and buck-passing are often correlated and, therefore, it is often difficult to separate the effect of the two motives. For example, subjects that postpone signing a saving scheme might do so because they hesitate before choosing one scheme and giving up on the others, because they prefer current consumption over future consumption or because of a combination of the two motives (Madrian and Shea, 2001). To test the effects of vigilance and buck-passing on the postponement of decisions we therefore conducted a lab-test. In the lab-test, the subjects faced an investment decision followed by a series of disinvestment decisions. We made all the subjects start the experiment and end it in the same time and, therefore, the subjects had no incentive to procrastinate because they could not influence the timing of the costs, the cognitive effort in making the decisions, or the timing of receiving the monetary benefits. In our lab-test, therefore, the subjects had *only* a buck-passing incentive to delay their disinvestment decisions because by disinvestment implies giving up on the opportunity to continue.

Sandri et al. (2011) find that in a setting similar to ours, most subjects tend to postpone their disinvestment decisions even when the postponement costs them significant loses. They also find that there is significant variation across individuals with some subjects seeming more inclined to postpone their decisions than the average subject and some subjects more inclined to disinvest in one of the early rounds. Based on psychological findings, we predict that the number of rounds played will be correlated with the subjects' scores of vigilance, buck-passing and risk-aversion. We expect that vigilant subjects were more likely than other subjects not to postpone the disinvestment decision whereas buck-passers tended to postpone disinvestment decisions even when the postponement cost them significant sum.

In addition, Janis and Mann (1977) suggest that subjects are more likely to process information when they perceive the outcomes as risky, whereas they tend to economize on cognitive resources when they believe that their choices will not significantly affect the outcomes. We therefore expect that in addition to subjects' buck-passing and vigilance traits, the subjects' disinvestment decisions will also depend on their risk-aversion scores because we expect that risk-averse subjects were more likely than other subjects to perceive the outcomes as risky.

We therefore define five groups of subjects. *Risk-averse vigilant* subjects are those subjects that have above average scores in both the vigilance and the Holt and Laury (2002) risk-aversion tests. *Risk-normal vigilant* subjects are those subjects that have above average scores in the vigilance test but below average scores in the risk-aversion test. *Risk-averse buck-passing* subjects are those subjects that have above average scores in both the buck-passing and the Holt and Laury (2002) risk-aversion tests. *Risk-normal buck-passing* subjects are those subjects that received above average scores in the buck-passing test but below average scores in the risk-aversion test. All other subjects compose our control group.

By studying the disinvestment decisions of the members of each of these groups relative to the decisions of members of the other groups, we attempt to contribute to understanding the effects of personality traits on economic outcomes. By studying the effects of buck-passing and vigilance on behavior, we may assist, for example, to identify the personality traits that make some subjects behave like rational agents whereas others buck-pass. Our results may therefore assist in predicting economic behavior and outcomes in environments where some of the agents have bounded rationality (Thaler, 1984, 1991, Angeletos et al., 2001, Grenadier and Wang, 2007).

4 Results

4.1 Probability of skipping a game

The first decision that each subject had to make in each of the six games that he played was whether or not he invests. Subjects that invested continued to play the disinvestment games and those that chose not to invest skipped the disinvestment games. Columns 1, 3 and 5 in Table 3 provide summary statistics on the likelihood that a subject skipped a game. We find that 11.2% of the games in the compound-interest treatment and 0% of the games in the negative-interest treatment were skipped. The difference is statistically significant (ANOVA F=22.7, p<0.01). It seems that the subjects skipped games in the compound-interest treatment but not in the decreasing-interest treatment because in the decreasing-interest treatment the disinvestment-prize was framed as a large sum whereas in the compound-interest treatments the disinvestment-prize was framed as a smaller sum plus interest. It seems that, consequently, subjects in the decreasing-interest treatments were less willing to skip than subjects in the compound-interest treatment because they were less willing to give up on the disinvestment-prize than subjects in the compound-interest treatment.

We also find that subjects in the compound-interest treatment were marginally more likely to skip losing games and high variance games than they were likely to skip other games. The ANOVA F of the interaction between the compound-interest and the type of games is 1.84 (p<0.10).These results therefore suggest that there were at least some subjects that tended to make their investment decisions on the basis of the expected returns and on the basis of the perceived risk.

Table 3. Share of Games skipped and rounds played, by type of game

	Treatment								
	Compound-Interest			Negative-Interest			Total		
Type of Game	**% of Skipped games**	**Number of Rounds Played**	**N**	**% of Skipped games**	**Number of Rounds Played**	**N**	**% of Skipped games**	**Number of Rounds Played**	**N**
Low-variance-low-first-prize	0.0%	8.1	53	0.0%	7.9	43	0.0%	8.0	96
Low-variance-high-first-prize	14.6%	5.9	41	0.0%	6.3	34	8.0%	6.08	75
High-variance-low-first-prize	5.8%	7.23	34	0.0%	7.4	41	2.7%	7.32	75
High-variance-high-first-prize	3.8%	5.9	45	0.0%	6.9	49	2.1%	6.4	94
Extra-profit-low-variance	9.5%	7.0	21	0.0%	5.4	21	4.7%	6.2	43
Extra-profit-high-variance	15.3%	6.1	26	0.0%	6.7	17	2.3%	6.3	42
Lose-low-variance	10.5%	5.5	19	0.0%	8.6	19	5.3%	7.1	38
Lose-high-variance	12.0%	6.7	25	0.0%	7.4	22	6.4%	7.0	47
Total	11.2%	6.7	264	0.0%	7.1	246	3.5%	7.0	510

Source: own calculations

The order of the games, however, did not seem to affect the investment decisions. The *F*-statistics for the order of the games and for the interaction between the order of the games and the type of treatment are both statistically insignificant (F=0.61, p>0.10 and F=0.89, p>0.10, respectively). The results therefore suggest that the subjects did not draw conclusions from one type of game to the others.

Thus, the results so far indicate that there were some differences between the likelihoods that subjects skipped games, and that these differences were correlated with the games' parameters. To test whether the investment decisions were also affected by subjects' personality traits and risk aversion we estimated a random effects Probit model on the likelihood that a subject skipped a game. The dependent variable is a *skip-game* dummy that equals 1 if a subject chose to skip a game and 0 if he chose to play.

To estimate the effect of the interactions between buck-passing, vigilance and risk-aversion we include in the regression four dummy variables. The first equals one if a subject is *risk-averse-vigilant* and zero otherwise. The second equals one if a subject is *risk-normal-vigilant* and zero otherwise. The third equals one if a subject is a *risk-averse-buck-passer* and 0 otherwise. The fourth equals one if a subject is a *risk-normal-buck-passer* and zero otherwise.

We also include in the regression controls for the games' attributes and for subjects' socio-demographic characteristics. As control for the games' attributes we include the *cost* which was either 10,000 or 15,000 points, the *disinvestment-prize* which was either 11,000 or 16,000 points, the *variance* which was either 200 or 1,000 points, the *first-prize* which was either 1,000 or 1,500 points and a dummy that equals 1 if the trial is a decreasing-interest-trial and 0 if the trial is in a compound-interest trial. As controls for subjects' socio-demographic characteristics we include the subjects' *age*, a *man* dummy that equals 1 if a subject is a man and 0 if he is a woman, a *student* dummy that equals 1 if a subject is a student and 0 otherwise and a *German-born* dummy that equals 1 if a subject was born in Germany and 0 otherwise.

We expect that a high investment *cost* will increase the likelihood that a subject skipped a game and that high *disinvestment-prizes* and high *first-prizes* will decrease the likelihood that a subject will skip a trial. At the same time, we do not have a prediction for the effect of the *variance* because the theory of real-options suggests that an increase in the variance increases the expected payoffs but it also increases the perceived riskiness. The results are summarized in the first column of Table 4.

Table 4. The likelihood that a subject skipped a game

Dependent Variable	Skip-game			
	All games		Only positive-treatment-games	
	1	2	3	4
Risk-averse-vigilant	0.50 (0.370)	0.50 (0.370)	0.50 (0.370)	0.50 (0.370)
Risk-normal-vigilant	0.71** (0.347)	0.71** (0.347)	0.71** (0.347)	0.71** (0.347)
Risk-averse-buck-passers	0.13 (0.388)	0.13 (0.388)	0.13 (0.388)	0.13 (0.388)
Risk-normal-buck-passers	0.17 (0.335)	0.17 (0.335)	0.17 (0.335)	0.17 (0.335)
Cost-of-playing	0.0002** (0.00008)		0.0002** (0.00008)	
Disinvestment-prize	0.0001 (0.00009)		0.0001 (0.00009)	
Difference between disinvestment-prize and cost-of-playing		0.0001 (0.0001)		0.0001 (0.0001)
Variance	-0.0001 (0.0003)	-0.0001 (0.0003)		-0.0001 (0.0003)
First-prize	-0.001 (0.001)	0.001* (0.0007)	-0.001 (0.001)	0.001* (0.0007)
Negative-treatment	-5.85 (4056.059)	-5.85 (4056.059)		
Age	0.002 (0.021)	0.002 (0.021)	0.002 (0.021)	0.002 (0.021)
Men	0.51* (0.294)	0.51* (0.294)	0.51* (0.294)	0.51* (0.294)
Student	0.49 (0.431)	0.49 (0.431)		0.49 (0.431)
German-born	0.20 (0.310)	0.20 (0.306)	0.20 (0.306)	0.20 (0.306)
Skip-optimal		1.32* (0.727)		1.32* (0.727)
Constant	-4.72*** (1.410)	-4.72*** (1.410)	-4.72*** (1.410)	-4.72*** (1.410)
Observations	510	510	264	510
χ^2	12.91	12.91	12.91	12.91

*- p<0.10 **- p<0.05 ***- p<0.001

Source: own calculations

We find that *risk-normal-vigilant* subjects have a significantly greater likelihood of skipping games than all the other subjects. For example, the probability that a German born 27.8 years old male student that is not vigilant will skip a low-variance-low-first-prize game is 3.0%. The probability that a risk-normal-vigilant subject with the same characteristics will skip a low-variance-low-first-prize game is 12.2%, more than four times greater. At the same time, risk-averse-vigilant subjects, risk-averse buck-passers and risk-normal buck-passers have probabilities of skipping a game that are not statistically different than those of all the other subjects.

Assuming that the subjects made decisions to maximize their payoffs, it therefore seems that risk-normal-vigilant subjects had different expectations about their payoffs from playing than other subjects. Whereas both risk-averse vigilant subjects and all the other subjects seem to have expected that they will gain more by playing than by skipping, risk-normal-vigilant subjects seem to have been more doubtful about their ability to profit from playing. A possible explanation is that risk-normal subjects often expected that they will not process all the information in every round because the effect of each disinvestment decision on the payoff is small and, therefore, subjects that are not risk-averse are likely to expect that they will not consider the disinvestment decision in each round as risky. Only subjects that are vigilant, however, are likely to follow through on this expectation and skip the games, because non-vigilant subjects are likely to find it cognitively stressful to give up on the opportunity to play.

Besides vigilance and risk-aversion, the coefficients of the controls suggest that the probability of skipping games mainly depends on the investment *cost*. When the *cost* increases, all subjects become significantly more likely to quit. The *variance*, the *initial-prize* and the *disinvestment-prize*, on the other hand, do not seem to have significant effects on the likelihood that subjects skip games. [4]

To test the robustness of our results on the effects of risk-aversion and vigilance, we conducted several robustness checks. The second column of Table 3 reports the results when we add to the regression a *skipping-is-optimal* dummy that equals 1 if a game is skipped that is a losing-game and 0 otherwise. Because *skipping-is-optimal* is linearly correlated with the costs and the disinvestment-prizes, we replace the cost and *disinvestment-prize* variables in this regression by the difference between the disinvestment-prizes and the costs.

We find that the coefficient of *skipping-is-optimal* is negative and statistically significant, suggesting that subjects were more likely to skip losing games than all other games. [5] The

[4] These results should be interpreted with some caution because in our settings the costs are strongly correlated with the first round's prizes and the disinvestment-prizes. The inclusion or the removal of some or all of these controls does not significantly affect, however, the coefficient of risk-normal vigilant subjects.

[5] We also interacted the *skipping-is-optimal* dummy with the dummies for *risk-averse-vigilant*, *risk-normal-vigilant*, *risk-averse-buck-passers* and *risk-normal-buck-passers*. The coefficients of all the interaction variables were statistically insignificant.

effect of risk-normal-vigilant subjects, however, remains negative and significant. Thus, the results suggest that even after controlling for games in which the expected payoffs were smaller than the payoffs from skipping, risk-normal vigilant subjects are more likely to skip games than all other subjects.

Columns 3-4 summarize the results of repeating the two regressions using only observations on games in the compound-interest treatments. This has no effect on any of the results.

4.2 Rounds played until quitting

Each subject that chose to invest continued to the first round of the game. Before each round, the subject received information about the prizes he won so far, about the prize he won in the current round and about the possible prizes he could win in the following rounds. The subject then had to choose whether he continues or disinvests. Real options theory suggests that the optimal strategy for a risk-neutral subject is to disinvest in the first round in which the round's prize drops below the disinvestment trigger. The conflict theory of decision making, however, predicts that subjects face stress when making a disinvestment decision because disinvestment implies giving up on the option to continue playing. We therefore expect that subjects that cannot handle this stress efficiently will continue to play even when the expected payoffs from playing are smaller than the profits from disinvesting (Janis and Mann, 1977, Mann et al., 1997).

We test this prediction by estimating a semi parametric Cox proportional hazard model on the likelihood that a subject will disinvest. The dependent variable is a dummy that equals 1 if a subject disinvested in the given round and 0 if he continued to the consecutive round. We use robust standard errors and we cluster the observations by subject. To test our main hypothesis we include in the regression dummies for *risk-averse-vigilant* subjects, *risk-normal-vigilant* subjects, *risk-averse-buck-passers* and *risk-normal-buck-passers*, defined as above.

We also include controls for the games' attributes and the subjects' characteristics. As controls for the games' attribute we include the *cost*, the *disinvestment-prize*, the *round's-payoff*, the *variance* and a *negative-treatment-dummy*. As controls for subjects' characteristics we include, as in the previous subsection, the subjects' *age* a dummy for *male* subjects, a dummy for *students*, and a dummy for subjects that were *born-in-Germany*.

Real options theory predicts that the *disinvestment-prize* will have a negative effect on the number of rounds played because when the *disinvestment-prize* increases from 11,000 to 16,000, the 10% interest on continuing to the next round increases from 1,100 per round to 1,600 points per round. In addition, we expect that subjects usually do not quit when they receive a large *round's payoff* and that, consequently, the rounds' payoffs will have a positive effect on the likelihood that a subject will continue to the consecutive round.

Table 5. The likelihood of disinvestment

	1	2	3
Risk-averse-vigilant	0.26* (0.137)	0.24* (0.135)	0.26* (0.137)
Risk-normal-vigilant	-0.02 (0.123)	-0.02 (0.122)	-0.02 (0.122)
Risk-averse-buck-passers	-0.02 (0.153)	-0.02 (0.151)	-0.02 (0.152)
Risk-normal-buck-passers	-0.11 (0.127)	-0.12 (0.126)	-0.11 (0.126)
Cost-of-playing	-0.000005 (0.00001)	0.00001 (0.00001)	
Disinvestment-prize	0.00006*** (0.00002)		
Variance	-0.00001 (0.001)	0.0001 (0.0001)	
Rounds' prize	-0.00004 (0.0003)	-0.00003 (0.00002)	
Trigger-prize		0.0003*** (0.0001)	0.0004*** (0.0001)
Minimum possible prize			-0.00004** (0.00002)
Maximum possible prize			0.000009 (0.00002)
Negative-treatment	-0.22** (0.111)	-0.23** (0.109)	-0.22** (0.111)
Age	-0.008 (0.007)	-0.008 (0.007)	-0.008 (0.007)
Men	-0.02 (0.096)	-0.03 (0.095)	-0.03 (0.096)
Student	-0.07 (0.137)	-0.07 (0.138)	-0.07 (0.136)
German-born	-0.12 (0.117)	-0.12 (0.114)	-0.13 (0.114)
Observations	3510	3510	3510
χ^2	33.0***	24.8***	30.2***

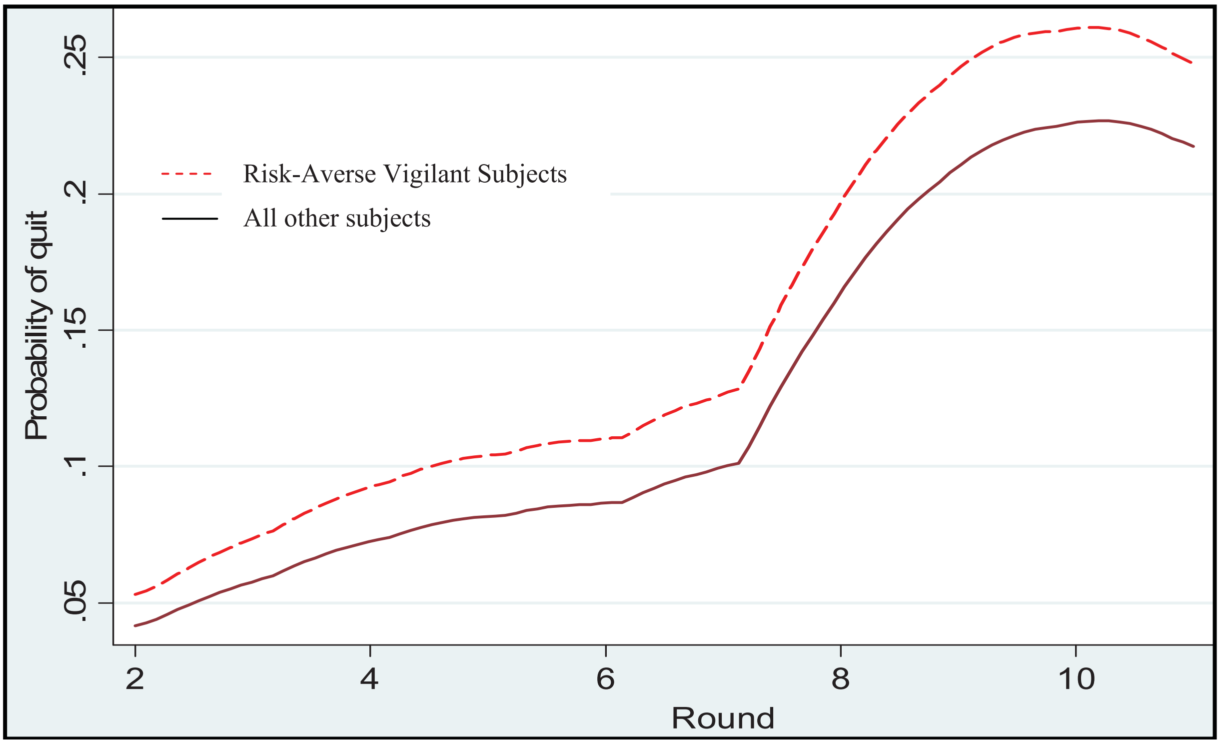
*- p<0.10 **- p<0.05 ***- p<0.01

Source: own calculations

As above, we do not have predictions about the coefficient of *variance* because an increase in the variance increases the perceived risk but it also increases the expected payoffs for a player that expects to disinvest in time. If subjects are not affected by framing biases, then the *negative-treatment* dummy should have no effect on the probability of disinvesting because the negative-interest and the compound-interest treatments are normatively the same. However, we include the *negative-treatment* dummy in the regression because in the compound-interest treatment, the disinvestment-prizes are presented as constant over the rounds and only the interest payoffs decrease with every passing round whereas in the negative-interest treatment, the disinvestment-prizes themselves decrease with every passing round. We therefore include the *negative-treatment* dummy in the regression to control for the possibility that the differences in the framing had an effect on the subject's disinvestment decisions. The results are summarized in the first column of Table 5.

Ceteris paribus, it seems that in every round, risk-averse-vigilant subjects are more likely to disinvest than other subjects whereas risk-normal vigilant subjects, risk-averse buck-passers, risk-normal buck-passers and subjects in the baseline group seem to have similar probabilities of disinvestment. Figure 3 depicts this result graphically. For each round, the solid line depicts the probability that a risk-averse-vigilant subject will quit and the dashed line depicts the probability that subjects that are not risk-averse and vigilant will quit. The differences between the solid and the dashed lines suggest that for every round, the probability that a risk-averse-vigilant will quit is about 5% - 10% greater than the probability that other subjects will quit. Thus, for example, if the game is a compound interest low-variance-low-first-prize game, the expected number of rounds that a 27.8 German born student that is not risk-averse-vigilant is expected to play is 8.4. A risk-averse-vigilant subject with the same characteristics, on the other hand, is expected to play 6.6 rounds, 21% less than the not risk-averse-vigilant subject.

Figure 3. Probability of quitting



Source: own calculations

Thus, the results suggest that only subjects that are both vigilant and risk-averse tend to disinvest early whereas other subjects tend to play a significantly greater number of rounds. It therefore seems that vigilance is a necessary but not sufficient condition for early disinvestment. A possible explanation is that risk-averse subjects tend to perceive the decision in every round as risky whereas other subjects tend to believe that disinvesting in the current round will not have a large effect on their payoffs relative to disinvesting in the consecutive round. Thus, risk-averse subjects were more likely to process all the relevant information than other subjects. Consequently, risk-averse subjects were more likely than other subjects to recognize when a round's prize dropped below the disinvestment trigger. Only subjects that were also vigilant, however, were also likely to follow through on their decision and disinvest because non vigilant subject were likely to face too much stress when they had to execute an early disinvestment decision.

The coefficients of the other controls seem to suggest that, as predicted above, the effect of the *disinvestment-prize* is positive, suggesting that the subjects understand that when the disinvestment-prizes are greater, the interest costs of continuation are also greater. At the same time, it seems that framing also has some effect. The coefficient of *negative-interest* is negative and significant, suggesting that subjects are more likely to disinvest early in the compound-interest treatment than in the negative-interest treatment, perhaps because in the negative-interest treatment the disinvestment prizes are framed as decreasing over time and, consequently, the subjects in the negative-interest treatment are mislead to believe that disinvestment becomes less profitable with every round played.

To test the robustness of the results, we conducted several checks, adding variables that the literature suggests that are likely to have some effect on subjects' decisions. First, we add a *trigger-prize* variable to test whether, as suggested by real options theory, subjects are more likely to quit when the trigger prizes are high. The results are summarized in the second column of Table 5.

As a second robustness check, we follow the suggestion by Loewenstein and Lerner (2003) that subjects often tend to make decisions by focusing on the worse or on the best outcome. We expect that subjects that use this heuristic will tend to quit when either the maximum or minimum prizes they can win will drop below a certain threshold. We therefore include in the regression a *minimum-possible-payoff* variable that receives the worst possible payoff in the 11^{th} round and *maximum-possible-payoff* variable that receives the best possible payoff. For example, in Figure 2, the *minimum-possible-payoff* is -600 points and the *maximum-possible-payoff* is 3,000 points. The results are summarized in the third column of Table 5.

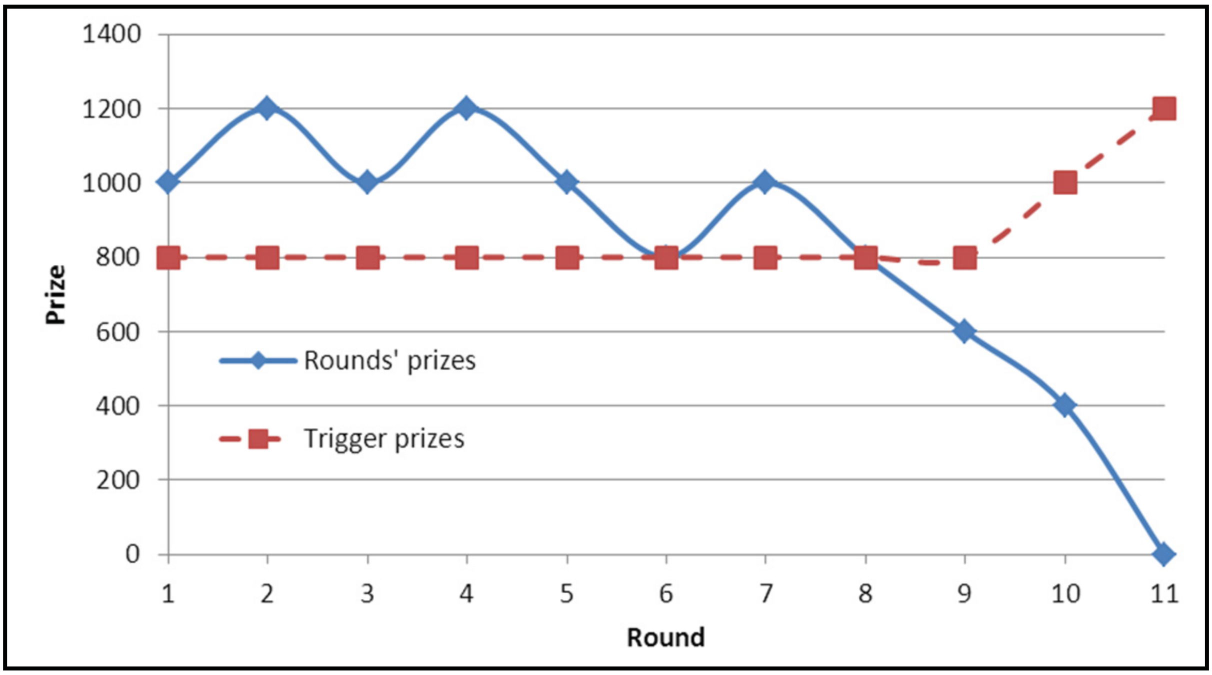
Summarizing the results of both robustness checks we find that whereas both *trigger-prize* and *minimum-possible-payoffs* have significant effects on the probability of disinvestment, the inclusion of these variables does not affect, however, the significance of the *risk-averse-vigilant* dummy. It therefore seems that there is some variance in the subjects' decision making process with some subjects making their disinvestment decision on the basis of the differences between the rounds' prizes and the trigger prizes and some basing their decisions on a simplifying heuristic. However, controlling for the differences in the subjects' decision making process does not diminish the effect of the *risk-averse-vigilant* dummy. It therefore seems that although subjects differ in their decision making process, risk-averse-vigilant subjects seem to be more able than other subjects to disinvest early, either because they reach other conclusions than other subjects or because they are more able than other subjects to handle the stress of giving up on the opportunity to continue playing.

4.3 Combined estimation: Rounds played and likelihood of skipping

The results of the previous subsections suggest that risk-normal-vigilant subjects are more likely to skip games than all other subjects and that risk-averse-vigilant subjects tend to disinvest earlier than other subjects. In this subsection we therefore study the behavior of vigilant subjects further by using a Heckman two stage procedure to test the optimality of the subjects’ disinvestment decisions, contingent on their first stage decisions to invest.

Thus, the dependent variable in the first stage is a *play-game* dummy that equals 1 if a subject played the game and 0 if he skipped it. The dependent variable in the second stage is a variable that measures the *distance-from-optimality* of the subjects’ decisions and which we define as follows. First, we define the decision to disinvest at the first round in which the round’s prize dropped below the trigger prize as the *optimal decision*. When a subject makes an *optimal decision*, we say that he played the *optimal number of rounds*. The *distance-from-optimality* is, therefore, the difference between the number of rounds that a subject played and the optimal number of rounds.

Figure 4. Example for a decision-situation faced by a subject (disinvesting in period 6 would be optimal)



Source: own calculations

For example, figure 4 depicts the decisions made by a subject in a low-variance-low-first-prize game. The thick line represents the prizes that the subject won in each round and the dashed line represents the trigger prizes. The subject would have made the optimal decision if he were to quit in the sixth round because the sixth round is the first round in which the round's prize dropped below the trigger prize. The subject, however, played until the 10th round. The subject's *distance-from-optimal* was therefore $10-6=4$ rounds. We find that the average *distance-from-optimal* is 4.4 rounds and that this average is significantly greater than zero (t=23.1, p<0.01).

Table 6. Rounds played, conditional on investing in the investment stage

	1		2	
	Play-game	**Absolute-difference**	**Play-game**	**Absolute-difference**
Risk-averse-vigilant	-0.50 (0.370)	-0.86** (0.403)	-0.50 (0.370)	-0.96* (0.593)
Risk-normal-vigilant	-0.709** (0.347)	0.03 (0.371)	-0.709** (0.347)	-0.07 (0.543)
Risk-averse-buck-passers	-0.13 (0.388)	-0.03 (0.390)	-0.13 (0.388)	-0.05 (0.580)
Risk-normal-buck-passers	-0.17 (0.335)	0.371 (0.363)	-0.17 (0.335)	0.32 (0.537)
Cost-of-playing	-0.0002** (0.00008)	0.003*** (0.0009)		
Disinvestment-prize	-0.0001 (-0.00008)	-0.0001 (0.00008)		
Difference between disinvestment-prize and cost-of-playing			-0.00009 (0.00009)	-0.0002*** (0.00007)
Variance	0.0001 (0.0003)	-0.00003 (0.0003)	0.0001 (0.0003)	0.00003 (0.0005)
First-prize	0.001 (0.001)	-0.003** (0.001)	-0.001* (0.0007)	-0.002** (0.0009)
Negative-treatment		0.083 (0.431)		0.275 (0.617)
Age	-0.002 (0.002)		-0.002 (0.002)	0.04 (0.032)
Men	-0.51* (0.294)	-0.12 (0.307)	-0.51* (0.294)	-0.19 (0.452)
Student	-0.49 (0.431)	0.01 (0.397)	-0.49 (0.431)	-0.01 (0.590)
German-born	-0.20 (0.307)	0.04* (0.022)	-0.20 (0.307)	
Skip-optimal			-1.32* (0.727)	
Constant	4.724*** (1.41)	4.25*** (1.278)	4.724*** (1.41)	5.19*** (1.68)
Observations	510		510	
χ^2	63.5***		33.5***	

*- p<0.10 **- p<0.05 ***- p<0.01

Source: own calculations

To test the differences between vigilant, buck-passing, risk-averse and risk-normal subjects, we include in both stages of the estimation dummies for *risk-averse-vigilant* subjects, *risk-normal-vigilant* subjects, *risk-averse-buck-passers* and *risk-normal-buck-passers*. As further controls we include *cost-of-playing, disinvestment-prize, first-prize, variance and negative-treatment*, *age, man, studen*t and *German-born*. Column 1 in Table 6 summarizes the results for the first stage of the estimation and Column 2 summarizes the results for the second stage.

As above, we find that the effect of being a risk-normal-vigilant subject on the probability that a subject will play a game is negative and significant. The likelihood, for example, that a risk-normal-vigilant 28.7 years old male student that was born in Germany will skip a compound-interest low-variance-low-first-prize game is 8.5%. If this subject becomes either not-vigilant or risk-averse, the likelihood he skips the game drops by 78% to 1.9%. When risk-normal vigilant subjects chose to play a game, however, the statistically insignificant coefficient of *risk-normal-vigilant* reported in Column 2 suggests that risk-normal vigilant subjects did not play more optimally than other subjects. The results therefore suggest again that risk-normal vigilant subjects are more likely than other subjects to skip games because they expect that if they will play they will not play optimally and they are also more able than other subjects to efficiently handle the stress of giving up on the opportunity to play.

At the same time, the negative and significant coefficient of *risk-averse-vigilant* subjects in the *distance-from-optimal* column suggests that conditional on their decision to play, the disinvestment decisions of *risk-averse-vigilant* subjects tended to be closer to the optimal decision than the disinvestment decisions of other subjects. For example, in a compound-interest low-variance-low-first-prize games, the expected distance-from-optimal of a 28.7 years old male student that was born in Germany is 3.9. If this subject was a risk-averse-vigilant subject, his distance-from-optimal would decrease by 21.6% to 3.1 rounds. The results therefore suggest that *risk-averse-vigilant* subjects played fewer rounds than other subjects because they played more optimally than other subjects and not because they preferred to play shorter rather than longer games.

Thus, the results strengthen the finding that in the settings of our experiment, a combination of vigilance and risk-aversion is a necessary condition for optimal decision making. It seems that subjects that have both these traits are able to efficiently process the information that they receive in every round and that they are also able to execute a disinvestment decision without hesitating very long. It seems that most other subjects, on the other hand, either do not efficiently process all the information that they receive in every round or that they often hesitate for several rounds before executing a disinvestment decision.

To test the robustness of these results we conducted a robustness test by adding to the first stage regression a *skip-optimal* dummy that equals 1 if the game is a losing game and 0 otherwise. In addition, we replace the *cost-of-playing* and *disinvestment-prize* variables by the difference between the quit prize and the cost because including *skip-optimal* together with both *cost-of-playing* and *disinvestment-prize* causes a multi-collinearity problem.

We find that the coefficient of skip-optimal is negative and significant, suggesting that all subjects are more likely to skip losing games than other games. Including *skip-optimal* in the regression does not affect, however, the significance of the coefficient of the *risk-normal-vigilant* dummy. Thus, the finding that risk-normal vigilant subjects are more likely to skip games than other subjects seems to be a general phenomenon and not one that depends on greater likelihood to skip losing trials.

4.4 Payoffs

The results of the previous subsections suggest that risk-averse vigilant subjects play more efficiently than other subjects but we do not find that subjects with high scores of buck-passing play less efficiently than other subjects, although it seems likely that buck-passers will tend to continue playing even when other subjects disinvest (Mann et al., 1997). However, it is possible that this result is partly because the games lasted only up to 11 rounds and, therefore, the difference between the number of rounds played by buck-passers and the number of rounds played by other subjects was bounded. If there are differences between the abilities of buck-passers and other subjects to handle the stress of disinvestment decision, however, then it is possible that buck-passers will make smaller profits than other subjects because they will not disinvest even when the loses from continuing to play are great enough to make other subjects disinvest.

We therefore estimated a random effects regression on the subjects' payoffs in each game. The dependent variable is the subjects' profits in each game and the independent variables are the same as in the previous subsection. The results are summarized in Table 7.

We find that although risk-averse vigilant subjects seem to earn greater payoffs than other subjects, the differences between their profits and the profits of the other subjects are not statistically significant, suggesting that the effect of making suboptimal decisions on the payoffs is usually relatively small, perhaps because the maximum number of rounds is only 11 or because the variance in half of the games was only 200 points.[6] At the same time, the results suggest that risk-normal buck-passers tend to earn significantly smaller payoffs than all the other subjects. For example, in 11 of the games that they played, risk-normal buck-passers even earned negative payoffs, whereas all other subjects did not earn negative payoffs in even a single game. Thus, it seems that risk-normal buck-passers play significantly less efficiently than other subjects, either because they process the information less efficiently or because the stress that they feel prevents them from executing a disinvestment decision even when they realize that disinvesting is more profitable than continue playing.

[6] LR test does not reject the null that the payoffs of risk-averse vigilant subjects, risk-normal vigilant subjects and risk-averse buck-passers are statistically the same. The χ^2= 0.28 (p>0.10).

Table 7. Subjects' payoffs

Variables	Coefficients
Risk-averse-vigilant	29.17 (1570.558)
Risk-normal-vigilant	-793.19 (1422.559)
Risk-averse-buck-passers	-476.88 (1634.303
Risk-normal-buck-passers	-3256.31** (1505.023)
Cost-of-playing	0.20 (0.339)
Disinvestment-prize	2.18*** (0.339)
Variance	3.30** (1.418)
First rounds' prize	-2.48 (4.799)
Age	-96.90 (90.377)
Negative-treatment	-87.96 (1192.682)
Men	951.95 (1199.554)
Student	-2798.13* (1599.797)
German-born	-1328.38 (1526.236).
Constant	19,929.79*** (5237.441)
Observations	492
χ^2	108.64***

*- p<0.10 **- p<0.05 ***- p<0.01

Source: own calculations

5 Conclusion

The conflict theory of decision making suggests that making decisions is stressful because choosing one alternative implies giving up on the other alternatives (Janis and Mann, 1977, Mann et al., 1997, Loewenstein and Lerner, 2003). Janis and Mann (1977) suggest some subjects will be able to handle this stress efficiently, but many others will delegate their decision to a later period or to another decision maker. The first type of subjects is known as *vigilant* and the second as *buck-passers*.

We conducted an experiment that is composed of an investment stage followed by a game that lasts until the subjects decide to disinvest. The game stage, which is based on Sandri et al. (2010) is played only by subjects that chose to invest in the first stage. We find that subjects that had high scores of both risk-aversion and vigilance tended to make more efficient decisions than all other subjects, suggesting that these subjects are more efficient than other subjects in both processing information and in executing disinvestment decisions. Subjects that had high scores of vigilance and average or lower scores of risk-aversion were more likely than all other subjects to skip games, but when they chose to play they usually played as many rounds as all other subjects. It therefore seems that these risk-normal vigilant subjects have often predicted correctly that they will not play efficiently and, therefore, they chose to skip games more often than other subjects. All other subjects, and especially subjects that had high scores of buck-passing and average or low scores of risk-aversion, tended to invest in the first stage and then played an inefficiently large number of rounds. It seems, therefore, that most subjects, and especially subjects that had high scores of buck-passing and average or low scores of risk-aversion, are less efficient than vigilant subjects in handling the stress of disinvesting and, consequently, they often play a greater number of rounds and earn smaller profits than risk-averse vigilant subjects.

Although we focus on studying vigilance and buck-passing, we nevertheless feel that, given the correlation between buck-passing and procrastination in many real-life scenarios, our results may somewhat contribute to giving psychological interpretation to O'Donoghue and Rabin's (2001) model of procrastination (Mann et al., 1997). O'Donoghue and Rabin (2001) suggest that there are three types of subjects: *rational*, *sophisticated-naïve* and *naïve*. Our findings suggest that *rational s*ubjects are those that have high scores of both vigilance and risk-aversion. *Sophisticated-naives* are subjects that have high scores of vigilance but low scores of risk-aversion. Other subjects seem to behave like *naïve* subjects in O'Donoghue and Rabin (2001). In addition, Subjects that have high scores of buck-passing and low scores of risk-aversion, seem to be even worse than other subjects in their naivety and, consequently, they postpone their decisions even when the costs are such that all other subjects are inclined to a make a decision (Della Vigna and Malmendier, 2004, Grenadier and Wang, 2007).

Our results therefore suggest that buck-passing, vigilance and procrastination can contribute to the understanding of psychological motives in economic decisions. As such, the results suggest that further study can contribute to better predictions on intertemporal decisions, such as decisions about saving, investment, health, housings and other similar decisions (Madrian and Shea, 2001, Gul and Pesendorfer, 2004, Della Vigna and Malmendier, 2004, Grenadier and Wang, 2007, Harris, 2010).

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